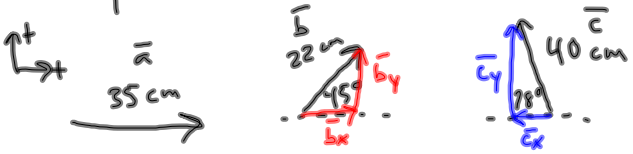
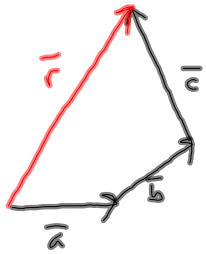
A ball rolls 35 cm east, turns and rolls 22 cm at 45° north of east, and finally rolls 40 cm at 78° north of west. Find the resultant displacement vector and the total distance.



(3)



(2) $a_x = 35$ cm

$b_x = (22\text{ cm})\cos(45°) = 15.56$ cm

$+\ c_x = -(40\text{ cm})\cos(78°) = -8.32$ cm

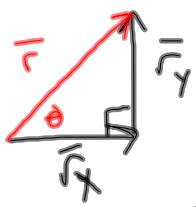
$r_x = 42.24$ cm

(2) $a_y = \not{0}$ cm

$b_y = (22\text{ cm})\sin(45°) = 15.56$ cm

$+\ c_y = (40\text{ cm})\sin(78°) = 39.13$ cm

$r_y = 54.69$ cm



$r^2 = r_x^2 + r_y^2$

$r = 69.1$ cm

$\tan\theta = \frac{r_y}{r_x}$

$\theta = \tan^{-1}\left(\frac{r_y}{r_x}\right)$

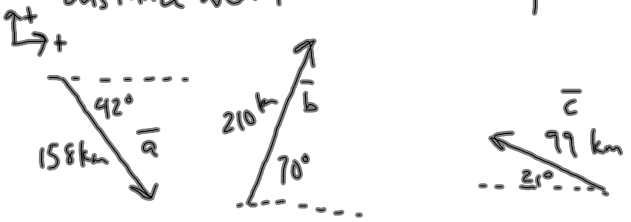
$= 52.32°$

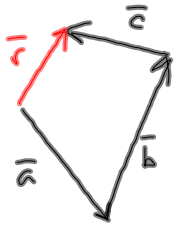
(2) (2) (1)

$\bar{r} = 69.1\text{ cm}\ @\ 52.32°\ N\ \text{of}\ E$

$d = 35\text{ cm} + 22\text{ cm} + 40\text{ cm} = 97\text{ cm}$

A plane flies 158 km at 42° South of east, the 210 km at 70° north of east, then 99 km at 21° north of west. Find the total distance and the resultant displacement vector.





$a_x = (158\text{ km})\cos(42^\circ) = 117.4\text{ km}$

$b_x = (210\text{ km})\cos(70^\circ) = 71.8\text{ km}$

$+\ c_x = -(99\text{ km})\cos(21^\circ) = -92.4\text{ km}$

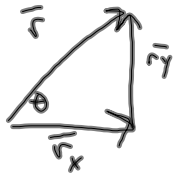
$r_x = 96.8\text{ km}$

$a_y = -(158\text{ km})\sin(42^\circ) = -105.7\text{ km}$

$b_y = (210\text{ km})\sin(70^\circ) = 197.3\text{ km}$

$+\ c_y = (99\text{ km})\sin(21^\circ) = 35.5\text{ km}$

$r_y = 127.1\text{ km}$



Pythagorean thm. to find r

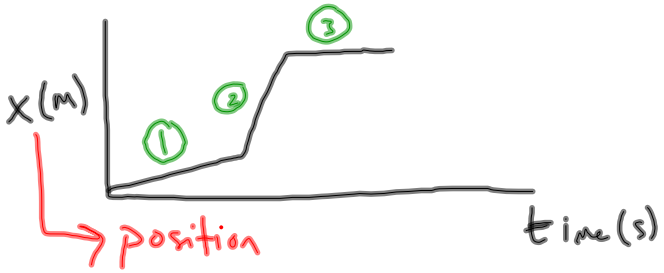
$r = 159.8\text{ km}$

$\theta = \tan^{-1}\left(\frac{r_y}{r_x}\right) = 52.7^\circ$

$\vec{r} = 159.8\text{ km}\ @\ 52.7^\circ\ N\ of\ E$

$d = 158\text{ km} + 210\text{ km} + 99\text{ km} = 467\text{ km}$

Displacement v. time graphs:



- highest slope to lowest → 2, 1, 3

- the velocity is the slope of a section of a function on a displacement v. time graph

- velocity of each section is known as the instantaneous velocity

- velocity of entire function is average velocity

- speed is the magnitude of velocity

$$\bar{V} = \frac{\Delta \bar{x}}{\Delta t}$$

$\Delta \bar{x}$ → change in position → displacement

Δt → change in time

$\bar{V}$ → velocity

$$\bar{V} = \frac{(\bar{x}_f - \bar{x}_i)}{(t_f - t_i)}$$

base units for velocity are $\frac{\text{meters}}{\text{seconds}}$ (m/s)